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# WAKE TOWER AND METHOD OF MAKING SAME

## SPECIFICATION

### Background of the Invention

**This is a Continuation In Part of Co-pending Application U.S. Serial No. 10/401,644 filed March 27, 2003.**

### Field of the Invention

The present invention relates generally to water sports to such as wakeboarding. More particularly, the invention concerns a wake tower of novel construction for use with powerboats for towing a performer behind the boat using a towrope that is connected to the wake tower.

In recent years the sport of wakeboarding has become very popular. As the name implies, the wake boarder intentionally rides the wake of the boat and prefers to have as large wake as possible generated behind the boat. Experience has shown that to take full advantage of the wake generated by the boat, it is preferable to anchor the towline used to tow the wake boarder at a relatively high elevation above the deck of the boat. Accordingly, a large number of elevated wake towers of various constructions have been suggested in the past.

Typically, the prior art wake towers comprise a rather large and somewhat

elaborate framework that is affixed to the boat deck. Such prior art wake towers are heavy and generally quite cumbersome to install and remove from the boat. Further, such towers may interfere with the boat's passage beneath bridges and other types of overpasses. Additionally, because of the complexity of the framework of several of the prior art wake towers, visibility of the operator of the boat can be impaired. Exemplary of prior art wake towers are those illustrated and described in U.S. Patent Nos. 5,979,350 issued to Larson et al. and 6,193,819 issued to Larson et al.

To accommodate the overhead clearance problem, certain of the prior art wake tower structures can be dismantled if necessary. However, such prior art structures often have questionable structural stability when erected and can present substantial safety hazards after being disassembled. For example, after the wake tower structures have been disassembled they can present a substantial tripping hazard to passengers on the boat especially when the boat is being rocked by waves. Further, in their dismantled configuration, the wake tower structures typically undesirably reduce the usable space on the boat deck.

Another approach to accommodating overhead clearance problems has been to construct a wake tower assembly that is pivotally interconnected with the boat so that the wake tower can be moved from an elevated position to a lowered position. Exemplary of this prior art approach, it is a wake tower assembly sold by

the Titan Company of Rancho Cordova, California.

## Summary of the Invention

By way of summary, one form of the wake tower assembly of the present invention comprises a first base member that can be connected to the gunwale on one side of a power boat; a second base member that can be connected to the gunwale on the opposite side to of a power boat; a generally U-shaped, structural member having a first curved side connected to the first base member and a second curved side connected to the second base member, each of the sides having an upper portion and a lower portion each of which is generally oval in cross-section, the lower portion of each of the sides having a first width and the upper portion of each of the sides having a second width less than the first width; and a bight portion interconnecting the upper portions of the sides, the bight portion being generally circular in cross-section. In one form of the invention, the U-shaped structural member can be pivoted downwardly toward the bow of the powerboat and in another form of the invention the U-shaped structural member can be pivoted downwardly toward the stern of the boat.

With the foregoing summary in mind, it is an object of the present invention to provide a highly attractive wake tower assembly of a unique, generally U-shaped configuration that can be readily mounted on powerboats of various constructions.

## Brief Description of the Drawings

Figure 1 is a generally perspective view of one form of the wake tower of The present invention shown affixed to the gunwales of a powerboat.

Figure 2 is a top view, partly in cross-section, illustrating one form of the method of the invention for making the wake tower.

Figure 3 is a side elevational view, partly in cross- section further illustrating the method of the invention for making the wake tower.

Figure 4 is a side elevational view, partly broken away to show internal construction, of the form of the wake tower shown in figure 1.

Figure 5 is a view taken along lines 5-5 of figure 4.

Figure 6 is a greatly enlarged, cross-sectional view taken along lines 6-6 of figure 5.

Figure 7 is an enlarged, cross-sectional view taken along lines 7-7 of Figure 6.

Figure 8 is in enlarged, cross-sectional view taken along lines 8-8 of figure 6.

Figure 9 is in enlarged, cross-sectional view taken along lines 9-9 of figure 6.

Figure 10 is a generally perspective, exploded view of one of the base members and one of the connecting segments of the wake tower of the invention.

Figure 11 is a fragmentary cross-sectional view of the lower portion of one side of the wake tower of the invention illustrating the manner in which the wake tower pivots relative to the base member.

Figure 12 is a generally perspective view of an alternate form of wake tower of the present invention shown mounted on the gunwales of a powerboat.

Figure 13 is a side elevational view illustrating the manner of making one of the side members of the wake tower shown in figure 12.

Figure 14 is a side elevational view of the wake tower of the alternate form of the invention shown in Fig. 12.

Figure 15 is an enlarged, cross-sectional view taken along lines 15-15 of figure 14.

Figure 16 is a view taken along lines 16-16 of figure 14.

Figure 17 is a greatly enlarged, cross-sectional view taken along lines 17-17 of figure 16.

Figure 18 is a cross-sectional view taken along lines 18-18 of figure 17.

Figure 19 is a cross-sectional view taken along lines 19-19 of figure 17.

Figure 20 is a cross-sectional view taken along lines 20-20 of figure 17.

Figure 21 is a fragmentary cross-sectional view similar to figure 17, but illustrating the rearward pivotal moment of the wake tower of the alternate form of the invention.

Figure 22 is a side elevational view of still another form of the wake tower of the invention that is cast from a metal such as aluminum.

Figure 23 is an enlarged, cross-sectional view taken along lines 23-23 of figure 22.

Figure 24 is a cross-sectional view taken along lines 24-24 of figure 23.

Figure 25 is a greatly enlarged cross-sectional view of the area designated as "25" in figure 22.

Figure 26 is a cross-sectional view taken along lines 26-26 of figure 25.

Figure 27 is a cross-sectional view taken along lines 27-27 of figure 25

Figure 28 is a generally perspective view of still another form of the wake tower of the present invention shown affixed to the gunwales of a powerboat.

Figure 29 is a side elevational view, of the form of the wake tower shown in figure 28.

Figure 30 is a view taken along lines 30-30 of figure 29.

Figure 31 is an enlarged, cross-sectional view taken along lines 31-31 of figure 29.

Figure 32 is an enlarged, cross-sectional view taken along lines 32-32 of figure 29.

Figure 33 is an enlarged, cross-sectional view taken along lines 33-33 of figure 29.

Figure 34 is an enlarged, cross-sectional view taken along lines 34-34 of figure 30.

Figure 35 is an enlarged, cross-sectional view taken along lines 35-35 of figure 30.

Figure 36 is an enlarged, cross-sectional view taken along lines 36-36 of figure 35.

Figure 37 is an enlarged, cross-sectional view taken along lines 37-37 of figure 35

Figure 38 is a cross-sectional view taken along lines 38-38 of figure 35.

Figure 39 is a cross-sectional view taken along lines 39-39 of figure 35.

Figure 40 is a generally perspective, exploded view of the base assembly shown in figures 35 through 39.

Figure 41 is a fragmentary, cross-sectional view similar to figure 35 showing the generally U-shaped, upwardly extending assembly pivoted into a stowed position.

Figure 42 is a fragmentary, cross-sectional view similar to figure 41 further, illustrating the downward and rearward pivotal movement of the U-shaped assembly.

## Description of the Invention

Referring to the drawings and particularly to figures 1, 4 and 5, one form of the wake tower of the invention is shown interconnected with a powerboat 30 of conventional construction having a bow portion 30a and a stern portion 30b. As best seen in figure 5, the powerboat also has first and second spaced apart gunwales 32 and 34 respectively to which the wake tower is connected. In the present form of the invention the wake tower includes an upwardly extending first base member 36 connected to the first gunwale 32 and an upwardly extending second base member 38 connected to said second gunwale 34. The base members 36 and 38 are of a curved configuration and are preferably cast from a lightweight metal such as aluminum.

Interconnected with the base members is a generally U-shaped, upwardly extending structural assembly generally designated by the numeral 40. The structural assembly 40 includes a generally "L" shaped structural member 42 having a first curved side 42a and a cast aluminum first connector segment 44. Structural member 40a is connected to aluminum first connector segment 44 by any suitable means such as welding. In a manner presently to be described, connector segment 44 is, in turn, pivotally connected to first base member 36. Structural assembly 40 also includes a second generally "L" shaped structural member 46 having a curved side 46a and a second, cast aluminum connector

segment 48 that is connected to second curved side 46a by any suitable means such as welding. Connector segment 48 is, in turn, pivotally connected second base member 38.

As will be discussed in greater detail hereinafter, each of the sides of structural assembly 40 is first swaged into the desired configuration and then is strategically formed to create a curved, tapered portion having an oval shape. More particularly, as best seen in figures 1 and 4, each of the sides of the structural assembly 40 includes a lower portion 51 having a first width W and an upper portion 53 having a second width W-1 that is substantially less than said first width W. structural assembly 40 further includes a bight portion 54 interconnecting upper portions 53 of the sides. As indicated in figure 4, bight portion 54 is generally circular in cross-section.

In the form of the invention shown in figures 1 through 11, the wake tower further includes a tow rope connector member 56 that is connected to and spans upper portion 53 of the sides 42 and 46. Connected to the connector member 56 is a conventional type of connector 58 to which the towrope "TR" can be connected.

Turning next to figures 6, 7 and 8, a portion of one side of the wake tower of the invention is there shown. It is to be understood that the other side of the wake tower is of a similar construction, but is not shown in the drawings in order to simplify the description. Each of the base members is provided with a cavity 60

and each of the connector segments is provided with a pair of spaced apart, downwardly extending ears 62 and 64 that are receivable within the base member cavities. As shown in figure 6, downwardly extending ear 62 has a bore 62a formed therein and, similarly, downwardly extending ear 64 has a bore 64a formed therein. Receivable within bore 62a is a pivot pin 66 about which side 46 and connector segment 48 can pivot in the manner shown in Fig. 11.

As illustrated in figures 9 and 10, pivot pin 66 extends through aligned bores 69 formed in base member 38. Similarly, a locking pin 72 is receivable within bore 64a formed in ear 64. Pivot pin 66 extends through aligned bores 73 formed in base member 38 and, when in position within these openings in the manner shown in figures 6 in 9, prevents pivotal movement of side 46 and connector segment 48 about pivot pin 66. As indicated by the phantom lines in figure 7, when the locking pin 72 is removed from the base member, the combination of side 46 and connector segment 48 is free to pivot about pivot pin 66 in the manner shown in figure 11.

In accordance with one form of the method of making the wake tower illustrated in figures 1 through 11, the first and second base members 36 and 38 are cast in a conventional manner from a suitable lightweight castable material such as aluminum and are appropriately finished. This done, the base members are interconnected with the powerboat by a plurality of threaded connectors 76 in the

manner shown in figure 6.

The side members 42a and 46a are each formed individually by first heating a first length of tubing to an elevated, annealing temperature. This first length of tubing, which by way of example can be 6061-T6 aluminum tubing that has a diameter of approximately 5 inches, a first end 80a and a second end 80b. In the manner illustrated in figure 2, the heated length of tubing is swaged in a conventional manner well known to those skilled in the art to form a first swaged tube 80 having a tapered swaged portion 82 having a first end 84 of first diameter D-1 and a second end 86 of a second lesser diameter D-2 and a uniform diameter portion 86 having a diameter D-3 substantially equal to said second lesser diameter D-2.

Using an appropriate forming dye, the tapered swaged portion 82 of the swaged tube 82 is strategically formed to produce a tapered swaged portion 82a and an elongated uniform diameter portion 86a (figure 3). As illustrated in figure 3, swaged portion 82a is generally oval shaped in cross-section and has a thickness "E". Swaged portion 82a has a width W-1, while uniform diameter portion 86a has a lesser width W-2. This swaging step is done in a conventional manner using conventional tooling that is of the character well understood by those skilled in the art.

Following the swaging step, the swaged to first tube 80 is strategically bent

into the desired shape to form a first bent tube that is generally "L" shaped in configuration and generally corresponds to the shape of member 42a.

Next, first connector segment 44 is cast in a conventional manner from a light weight castable material such aluminum and is connected by any suitable means such as welding to the bent tube formed by the swaging step to form a first wake tower subassembly 42, which generally corresponds to one-half of the structural assembly 40.

Following the forming of the first wake tower subassembly, a second length of aluminum tubing is swaged and formed in the identical manner described in the preceding paragraphs to produce a second side 46a. This done, second connector segment 48 is suitably cast from a light weight metal such as aluminum and is interconnected as by welding was second side 46a to form assembly 46 that generally corresponds to the second half of the structural assembly 40.

Next, the elongated, uniform diameter portions of the first and second wake tower subassemblies 42 and 46 are interconnected at their ends as by a welding to form the structural member 40.

After completion of the construction of the structural member 40 in the manner described in the preceding paragraphs, the structural member is pivotally interconnected with the base members 36 and 38 in the manner depicted in figures 6 through 10 of the drawings to form the construction shown in figures 1 and 3.

More particularly, the ears formed on each of the connector segments are inserted into the base cavities, the pivot pins 66 are inserted into bores 69 and 62a and the locking pins are inserted into bores 73 and 64a. With this construction, when it is desired to pivot the structural member into the forwardly stowed position in the manner illustrated in figure 11, locking pin 72 are removed from bores 73 and 64a to permit the structural member to pivot about pivot pin 66.

Turning next to figures 12 through 21 an alternate form of the wake tower of the invention is shown and generally designated by the numeral 90. This embodiment is similar in many respects to the embodiment shown in figures 1 through 11 and like numerals are used in figures 12 through 21 to identify like components. One of the main differences between this latest form of the invention and the earlier described form resides in the fact that the wake tower slopes rearwardly instead of forwardly and instead of being pivotally movable toward the bow of the boat is pivotally movable toward the stern of the boat as shown in Fig. 14 of the drawings.

Referring to figure 12 of the drawings, wake tower 90 is shown interconnected with a powerboat 30 of conventional construction having a bow portion 30a, a stern portion 30b and first and second spaced apart gunwales 32 and 34 respectively. In this latest form of the invention, the wake tower includes an upwardly extending first base member 96 that is connected to the first gunwale 32

and an upwardly extending second base member 98 that is connected to said second gunwale 34. The base members 96 and 98 are of a curved configuration and are preferably cast from a lightweight metal such as aluminum.

Interconnected with the base members is a generally U-shaped, upwardly extending structural assembly generally designated by the numeral 100. The structural assembly 100 includes a generally "L" shaped structural member 102 having a first curved side 102a and a cast aluminum first connector segment 104. Structural member 102 is connected to aluminum first connector segment 104 by any suitable means such as welding. In a manner presently to be described, connector segment 104 is, in turn, pivotally connected to first base member 96. Structural assembly 100 also includes a second generally "L" shaped structural member 106 having a curved side 106a and a second, cast aluminum connector segment 108 that is connected to second curved side 106a by any suitable means such as welding. Connector segment 108 is, in turn, pivotally connected second base member 98.

As in the earlier described embodiment of the invention, each of the sides of structural assembly 100 is first swaged into the desired configuration and then is strategically formed to create an elongated swaged portion having an oval shape (see figures 13 and 15). As indicated in figure 14, in this latest form of the invention, the bight portion 110 of the structural assembly 100 is also generally

oval shaped in cross-section. Unlike the earlier described embodiment of the invention, the tow rope TR is directly connected to a connector 112 that is connected to bight portion 110 proximate the center thereof.

Turning next to figures 17 through 21, a portion of one side of the wake tower of this latest form of the invention is there shown. It is to be understood that the other side of the wake tower is of a similar construction, but is not shown in the drawings in order to simplify the description. As best seen in figures 17 and 21, each of the base members is provided with a cavity 114 and each of the connector segments is provided with a pair of spaced apart, downwardly extending ears 116 and 118 that are receivable within the base member cavities. As shown in figure 17, downwardly extending ear 116 has a bore 116a formed therein and, similarly, downwardly extending ear 118, which has a length greater than the length of the ear 116, has a bore 118a formed therein. Receivable within bore 118a is a pivot pin 120 about which side 106 and connector segment 108 can pivot in the manner shown in figure 21. As illustrated in figures 19 and 20, pivot pin 120 extends through aligned bores 123 formed in base member 98. Similarly, a locking pin 124 is receivable within bore 116a formed in ear 116. Locking pin 124 extends through aligned bores 125 formed in base member 98 and, when in position within these openings in the manner shown in figures 17 and 20, prevents pivotal movement of side 106 and connector segment 108 about pivot pin 120. As indicated by the

phantom lines in figure 20, when the locking pin 124 is removed from the base member, the combination of side 106 and connector segment 108 is free to pivot about pivot pin 120 in the manner shown in figure 21.

In accordance with an alternate form of the method of making the wake tower illustrated in figures 12 through 21, the first and second base members 96 and 98 are cast in a conventional manner from a suitable lightweight castable material such as aluminum and are appropriately finished. This done, the base members can be interconnected with began my also the powerboat by a plurality of threaded connectors 129 in the manner shown in figure 17.

The side members 102a and 106a are each formed individually by first heating to an elevated, annealing temperature a first length of tubing, such as 6061-T6 aluminum tubing that has a diameter of approximately 5 inches. The heated length of tubing is swaged in a conventional manner well known to those skilled in the art to form a first swaged tube 130 of the general configuration shown in figure 12.

Using an appropriate forming dye, the swaged tube 130 is strategically formed so that it is generally oval shaped in cross-section. This swaging step is done in a conventional manner using conventional tooling that is of the character well understood by those skilled in the art. Following the swaging step, the swaged to first tube 130 is strategically bent into the desired shape to form a first bent tube

that is generally "L" shaped in configuration and generally corresponds to the shape of member 102a.

Next, first connector segment 104 is cast in a conventional manner from a light weight castable material such aluminum and is connected by any suitable means such as welding to the bent tube formed by the swaging step to form a first wake tower subassembly 102, which generally corresponds to one-half of the structural assembly 100.

Following the forming of the first wake tower subassembly, a second length of aluminum tubing is swaged and formed in the identical manner described in the preceding paragraphs to produce a second side 106a. This done, second connector segment 108 is suitably cast from a light weight metal such as aluminum and is interconnected as by welding was second side 106a to form assembly 106 that generally corresponds to the second half of the structural assembly 100.

Next, the first and second wake tower subassemblies 102 and 106 are interconnected at their ends as by a welding to form the structural member 100. After completion of the construction of the structural member 100 in the manner described in the preceding paragraphs, the structural member is pivotally interconnected with the base members 96 and 98 in the manner depicted in figures 6 through 10 of the drawings to form the construction shown in figures 12 and 16. More particularly, the ears formed on each of the connector segments are inserted

into the base cavities, the pivot pins 120 are inserted into bores 123 and 118a and the locking pins are inserted into bores 125 and 116a. With this construction, when it is desired to pivot the structural member rearwardly into the stowed position in the manner illustrated by the phantom lines in figure 14, locking pin 124 is removed from bores 125 and 116a to permit the structural member to pivot about pivot pin 120.

Referring to figures 22 through 27, still another form of the wake tower of the invention is there shown and generally designated by the numeral 140. This embodiment is also similar in many respects to the embodiment shown in figures 1 through 11 and like numerals are used in figures 12 through 21 to identify like components. The main differences between this latest form of the invention and that earlier described resides in the fact that the wake tower is cast by conventional casting techniques from a lightweight metal such as aluminum or from other suitable castable materials such as plastic.

Referring to figure 25 of the drawings, wake tower 140 is interconnected with a powerboat 30 of the previously described, conventional construction having a bow portion, a stern portion and first and second spaced apart gunwales. As before, the wake tower includes an upwardly extending first base member 36 that is connected to the first gunwale and an upwardly extending second base member 38 that is connected to said second gunwale. The base members are of a curved

configuration and are also preferably cast from a lightweight material such as aluminum or the like.

Interconnected with the base members is a generally U-shaped, upwardly extending structural assembly generally designated by the numeral 142. The structural assembly 142 includes a pair of generally "L" shaped structural members each having a curved side 142a and a connector segment 142b that includes a basewall 142c that closes the lower extremity of the curved sides 142a. The connector segments 142b are pivotally connected to the first and second base members in the manner previously described to enable the structural assembly to be pivoted into the stowed position as illustrated in figure 4. More particularly, as earlier discussed herein, the ears 62 and 64, which form a part of the connector segments, are inserted into the base cavities 60, the pivot pins 66 are inserted into bores 62a and the locking pins are inserted into bores 64a. With this construction, when it is desired to pivot the structural member into the stowed position in the manner previously described, locking pins 72 are removed from bores 73 to permit the structural member to pivot about pivot pins 66.

As best seen in figures 22 and 25, each of the sides of the structural assembly 140 includes a lower portion having a first width W and an upper portion having a second width W-1 that is substantially less than said first width W. Structural assembly 140 further includes a bight portion 144 that interconnects the

upper portions of the sides (figure 22). As indicated in figures 22, 23 and 24, bight portion 144 is generally circular in cross-section. At the time of assembly of the structural assembly 142, the bight portions are interconnected together by any suitable means such as welding (see figure 23). As illustrated in figure 26, the sides of the structural assembly are generally oval in cross-section. It is to be understood that the two sides of the wake tower 140 are of a similar construction, but only one side a shown in the drawings in order to simplify the specification.

In this latest form of the invention, like the form of the invention shown in figures 1 through 11, the wake tower 140 further includes a tow rope connector member 146 that is connected to and spans upper portion of the sides 142a. Connected to the connector member 146 is a conventional type of connector 58 to which the towrope "TR" can be connected.

Referring to figures 28 through 42 still another form of the wake tower of the invention is there shown and generally designated by the numeral 150. This embodiment is also similar in some respects to the embodiment shown in figures 1 through 11 and like numerals are used in figures 28 through 42 to identify like components. One of the main differences between this latest form of the invention and the earlier described form resides in the fact that the side portions of the wake tower are of a different shape and of a different cross-sectional configuration.

Referring particularly to figures 28, 29 and 30, wake tower 150 is shown interconnected with a powerboat 30 of conventional construction having a bow portion, a stern portion and first and second spaced apart gunwales 32 and 34 respectively. In this latest form of the invention, the wake tower includes a pair of upwardly extending base assemblies 152 that are connected to the first and second gunwales 32 and 34. Base assemblies 152, which are of identical construction, each comprise a base connector 154 and a side connector 156 which forms a part of a generally U-shaped, upwardly extending structural assembly generally designated by the numeral 160. In the manner shown in figure 41, generally U-shaped, upwardly extending structural assembly 160 is pivotally connected to the base connector (figure 35). The base connectors and side connectors are preferably cast from a lightweight metal such as aluminum.

Generally U-shaped structural assembly 160 includes a first side assembly 162, a second side assembly 164 and a bight portion 166. Each of the side assemblies 162 and 164, which are of substantially identical construction, is attached as by welding to one of the side connectors 156 in the manner best seen in figure 35. As shown in figure 29, a. towrope TR is directly connected to a connector 112 that is connected to bight portion 166 proximate the center thereof.

Referring particularly to figures 31, 32 and 35 it can be seen at that each of the side assemblies 162 and 164 comprises a pair of spaced apart, generally tubular

members 168 and 170 which curve upwardly and inwardly. Intermediate their lengths, the tubular members are interconnected by a generally tubular shaped cross member 172. At their lower extremities, the tubular members are connected to side connectors 156 as by welding and proximate their upper extremities are connected as by welding to bight member 166 which is oval in cross-section (figures 28 and 34). Tubular members 168 and 170 cooperate with side connectors 156 to define a generally triangularly shaped opening "O".

Having now described the invention in detail in accordance with the requirements of the patent statutes, those skilled in this art will have no difficulty in making changes and modifications in the individual parts or their relative assembly in order to meet specific requirements or conditions. Such changes and modifications may be made without departing from the scope and spirit of the invention, as set forth in the following claims.